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Predicting the risk of surface defects in continuous casting with advanced measurements and artificial intelligence

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Advanced steel grades present significant challenges in casting, and while surface defects cannot be completely avoided, it is crucial to minimize, identify, and predict their occurrence to save energy and resources. In the SMART-CAST II project (funded by Sweden's Innovation Agency), sophisticated measurement systems have been installed in the continuous casting lines of two Swedish steel producers. Artificial intelligence (AI) is employed for both the automatic detection of surface defects, and for the prediction of defects based on temperatures measured in the mould.
A fiber optic sensor system installed in the copper plates of the mould provides a detailed temperature map with high spatial and temporal resolution, measuring temperatures at thousands of positions every second. An automatic surface inspection system, installed immediately after the secondary cooling, uses AI to detect defects in images of the surface. Additionally, AI is used to find the connection between mould temperatures and process data, and the resulting product surface quality. Temperature data from the mould and surface quality data from inspection are used to train machine learning models to identify temperature patterns associated with the occurrence of surface defects on the product.
This work demonstrates the use of AI to process large amounts of temperature and image data, enabling early feedback to continuous casting personnel:
• Automatic detection of defects on the hot surface before cutting
• Identification of potential problem areas on the strand during casting
• Early warnings for mould conditions with a high risk of defects
Implementing this technique can significantly improve product quality and reduce waste in continuous casting.

Primary author: SUNDBERG, Jill (Swerim)

Co-authors: DAHLSTEDT, Anna (SSAB); AXELSSON, Fredrik (Alleima); ERIKSSON, Gunnar (Alleima); YU, Han (Swerim); ERIKSSON, Jan-Erik (Proximion); HANSSON, Karin (Alleima); FRÖJDH, Krister (Proximion)

Presenter: SUNDBERG, Jill (Swerim)

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